

## STUDIES OF SOME PORTO RICAN FUNGI

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(WITH PLATE XVIII)

The fungi reported and described in this paper represent a miscellaneous group of specimens from the collections of Dr. F. L. STEVENS in Porto Rico. They were selected by him and turned over to the author for study. Most of the numbers present points of special interest to the mycologist, as will be seen later in connection with the individual species. Type and co-type specimens are deposited in the herbarium of the University of Illinois, and in the herbarium of the New York Botanical Garden.

### COCCOMYCES De Notaris

COCCOMYCES CLUSIAE (Lev.) Sacc. Syll. Fung. 8:147. 1889.

On dead leaves of *Clusia rosea* Jacq., Maricao, July 19, 1915. nos. 882a, 8765 (figs. 8, 9, 10).

It is assumed that these specimens belong to this species. No exsiccata have been available for comparison and the descriptions extant are too meager to allow of a positive determination. The fungus, however, clearly belongs to the genus *Coccomyces*, and its occurrence on *Clusia* is regarded as being sufficient to warrant calling the specimens *C. clusiae*. For the convenience of other workers an emended description of the species follows:

Spots irregular, large, light-colored, amphigenous, thickly dotted with ascomata. Ascomata amphigenous, but chiefly hypophyllous, black, circular, subepidermal, erumpent, 0.5-2 mm. in diameter, rupturing with the epidermis by 4 or 5 radial splits. Paraphyses filiform, numerous, coalescing above into a brown epithecium. Asci long, narrow, cylindrical, 100-135  $\times$  7  $\mu$ , 8-spored; ascospores filiform, 1  $\mu$  in diameter and nearly as long as the asci, multicellular, hyaline.

Under the microscope the bottoms of empty ascomata present a curious, honeycombed appearance as the result of numerous pits in the hymenial layer (fig. 9). With the hope of finding an explanation for the pitted condition there found, microtome sections were made of the ascomata, some of which contained

asci and some of which did not. An examination of the sections disclosed the fact that, in certain regions of the hymenium, ascigerous hyphae do not develop. In these places there is, therefore, only a very thin covering formed over the bottom of the ascoma and a corresponding pit in the hymenial surface results. The formation of a large number of these pits causes the honeycombed appearance on the floor of older ascomata from which the asci have disappeared (figs. 9, 10).

*COCCOMYCES MUSAE* (Lev.) Sacc. Syll. Fung. 8:752. 1889.

On dead leaves of a cultivated species of *Musa*, Rio Maricao, above Maricao, September 10, 1913, no. 3631 (fig. 7).

With this, as with the preceding species, no exsiccati have been available for comparison, and the current descriptions are not such as would make possible an accurate determination. The fungus clearly belongs to the genus *Coccomyces*, however, and its occurrence on *Musa* is regarded as being sufficient, with other general superficial characters, to place it under the species already described for that host. Since, however, the previous description is so meager, an emended specific description is here given.

Spots amphigenous, whitish or straw-colored, roundish, 5-10 mm. in diameter, frequently confluent, uniformly but sparsely dotted with ascomata. Ascomata punctiform, black, 350-750  $\mu$  in diameter, rupturing irregularly by a 3 or 4-partite radial cleft. Asci cylindrical, short-stipitate, 55-90  $\times$  10-12  $\mu$ , 8-spored; ascospores long, rodlike, with obtuse ends, 50-70  $\times$  3  $\mu$ , hyaline and multiseptate at maturity. Paraphyses long, filamentous, numerous, exceeding the asci, hyaline.

#### MELIOLA Fries

The following species constitute a few that were overlooked, either because of their resemblance to other fungi, or because of their invidience on a host collected for the sake of other fungi upon it, when the monograph of Porto Rican *Meliolas* was compiled by Dr. STEVENS.<sup>1</sup>

*Meliola conferta*, sp. nov.—Spots amphigenous, irregularly circular, punctiform, 0.5-1 mm. in diameter. Mycelium brown, densely compacted, radiate, branches opposite, filaments 8  $\mu$  in diameter.

<sup>1</sup> STEVENS, F. L., The genus *Meliola* in Porto Rico. Ill. Biol. Monographs 2: no. 4. 1916.

Capitate hyphopodia opposite, exceedingly crowded, intricately interlocked with the hyphopodia of adjacent filaments, apical cell ovoid to globular,  $12 \times 18 \mu$  in diameter, basal cell  $3-6 \mu$  long. Mucronate hyphopodia few, opposite, situated mostly near the ends of the hyphae, bottle-shaped,  $18 \mu$  long. Mycelial setae none; perithecial setae few, 6-8, arising subapically, straight,  $7 \times 80 \mu$ , tips obtuse.

Perithecia  $120-135 \mu$  in diameter, rough; asci 2-spored, soon evanescent; ascospores brown, 4-septate, obtuse, slightly constricted,  $40 \times 15 \mu$ .

On leaves of *Rhacoma crossoptalum* L., Mona Island, December 20, 1913, no. 6147 (type) (figs. 17, 18, 19).

The compact habit of this species is very remarkable. Starting from a single spore, the spot develops into an exceedingly thick black mass. The hyphae are arranged radially and branch repeatedly, so that when the whole colony is seen under the microscope it is almost impossible to distinguish individual filaments. The radial habit, when the fungus is viewed in place on the host leaf, strongly suggests the radial character of an immensely large Microthyriaceous perithecium.

This *Meliola* is probably most closely allied to *M. parthesicola* Stevens, but can readily be separated from it because of its denser habit and the fact that the perithecial setae arise subapically instead of basally. What appears to be a constant manner of spore germination has repeatedly been seen. From one of the end cells of the spore there is put out a capitate hyphopodium (fig. 18) which acts as an anchor for the spore. Following this, filaments are sent out from the other cells of the spore and begin to branch and rebranch immediately. Thus the characteristic compactness of growth is assumed almost with the germination of the spore.

MELIOLA PEREXIGUA Gaill. Le Genre *Meliola*. 98. 1892.

On leaves of *Petiveria alliacea* L. at Corozal, February 21, 1913, no. 415.

This species has not hitherto been reported from Porto Rico, or on this host. The specimen, however, agrees thoroughly with GAILLARD's description of the species.

MELIOLA ASTERINOIDES Wint. Hedwigia 96. 1886.

On the upper surfaces of leaves of *Genipa americana* L., no. 7135 (figs. 11-16).

This specimen is referred to this species with some hesitation. The description given by GAILLARD<sup>2</sup> characterizes the fungus as forming very small colonies, 0.25-1 mm. in diameter, with only a small number of subdimidiate

<sup>2</sup> GAILLARD, A., Le Genre *Meliola*. 58. 1892.

perithecia (often only one) near the center of the spot, each of which sends out long radial filaments. Although no exsiccati having been available for comparison, it was impossible to be certain of a correct interpretation of the description, our specimen seems to show certain more or less inconformable characters.

The colonies are large, 1-5 mm. in diameter, and give rise to a comparatively large number of perithecia scattered uniformly throughout the entire colony. The perithecia are dimidiate, rather than subdimidiate, and are made up of radiating hyphae which extend somewhat beyond the limits of the perithecium to form an areola (fig. 16) somewhat similar to, but entirely distinct in aspect from that surrounding the perithecia of *M. aibonitensis* Stevens, *M. comocladiae* Stevens, etc.

GAILLARD called attention to the Microthyriaceous aspect of the perithecia of *M. asterinoides*, but the present specimen may be seen actually to possess Microthyriaceous characters in its dimidiate and radially formed perithecium which opens by a false ostiole. It is possible, therefore, that the specimen may throw some light upon the phylogenetic relationship of the genus.

In mycelium and spores, this specimen is characteristically a *Meliola*; but in perithecial development and characters it is almost typically Microthyriaceous. The development of the perithecium begins by the extrusion of a hyphopodium-like branch, 1 or 2 cells long, at some point, usually near the growing tip (fig. 12) of a filament. The tip of this special branch then becomes swollen (fig. 11a), and just beneath the swollen part a small thumblike projection (fig. 11b) is sent out in such a manner that, at its completion, what may be termed the first stage resembles somewhat the profile of a closed fist. The thumblike portion now grows until it reaches approximately two-thirds the size of the enlarged tip, and lies alongside it (fig. 12a). There now appear, along the outer edges of the 2 prongs thus formed, evident indentations (fig. 13a) that eventually cut the tip of the perithecial branch into 5 or 6 cells, which may be regarded as perithecial mother cells. Simultaneously with the appearance of the marginal indentations, one finds growing out radially from beneath the edges of the perithecial mother cells a number of rather light colored hyphae (fig. 13b) which, as growth continues, eventually form a complete circle of elongated radiating cells (fig. 14a) about the cells from which they originated. When

the circle has reached full development most of its cells will be found to possess terminal indentations (fig. 14*b*), indicative of a dichotomous scheme of branching, and from beneath the outer edges of some cells may already be seen (fig. 14*c*) the beginning of a new circle similar to the last.

Thus by the addition outwardly of circle after circle of radiating, dichotomously branching cells (figs. 15, 16) the complete perithecium is formed. Fig. 16 shows a mature perithecium illustrating the true dimidiate character. On ripening, the central portion becomes black and opaque, so that it is impossible to see the hyphal structure, but around the edge there is always apparent the areola of radiating close lying hyphae, some of which extend outward rather farther than the others and are capped by a hyphopodium-like head cell (fig. 16*a*). In some cases these elongated hyphae from the perithecial areola may even send out capitate hyphopodia laterally.

The false ostiole is a character which, if taken together with the dimidiate character of the perithecium, may also be of some phylogenetic significance.

Although *Meliola* has never been definitely allied to the Microthyriaceae, ENGLER referring it to the Aspergillaceae and SACCARDO to the Perisporiaceae, the impression is becoming more and more firmly rooted that *Meliola* is closely related to the Microthyriaceae. In this connection, the present specimen shows certain characters which strengthen that impression. The specimen may even be regarded as a transitional stage connecting this genus with the typical genera of the Microthyriaceae.

***Meliola cestri***, sp. nov.—Colonies epiphyllous, irregularly circular, 1–3 mm. in diameter. Mycelium dark, straight, forming a rather close network, filaments 9–10  $\mu$  in diameter.

Capitate hyphopodia alternate, 35  $\mu$  distant, head-cell cylindrical to globose, 16–20  $\times$  8–13  $\mu$ ; basal cell 4–5  $\mu$  long. Mucronate hyphopodia opposite, bottle-shaped, 24–28  $\times$  9  $\mu$ . Perithecial setae none; mycelial setae numerous, straight, black, 650–850  $\times$  10–11  $\mu$ , tips obtuse.

Perithecia numerous, grouped in the center of the colony, surrounded by an areola of hyphae when young, smooth, 225–275  $\mu$

in diameter. Asci soon evanescent; ascospores 4-septate, dark brown, cylindrical,  $50-55 \times 18-20 \mu$ , definitely constricted at the septa.

On leaves of *Cestrum* species, Mayaguez, June 29, 1915, no. 7576 (type).

This species is entirely distinct from *M. gesnerii* Stevens, which has also been reported on this host.

*MELIOLA CLUSIAE* Stevens, Ill. Biol. Monographs 2:75. 1916.

On *Clusia gundlachi* Stahl, El Alto de la Bandera, July 15, 1915, no. 8670. Previously reported on *Clusia rosea* Jacq.

***Meliola bayamonensis***, sp. nov.—Colonies hypophyllous, 2-5 mm. in diameter, mycelium a very loose network of threads; branches alternate, hyphae dark,  $4 \mu$  in diameter, wavy.

Capitate hyphopodia alternate,  $30-60 \mu$  distant, the head cell globose to oval,  $8-10 \mu$  in diameter; the basal cell variable,  $6-16 \mu$  long. Mucronate hyphopodia few, alternate,  $14 \mu$  long. Mycelial setae none; perithecial setae 5-7, arising basally, decumbent, dark brown to opaque,  $225 \times 4-5 \mu$ , apex acute.

Perithecia scattered,  $100-135 \mu$  in diameter, rough. Asci soon evanescent, ascospores 4-septate,  $27-30 \times 7 \mu$ , slightly constricted at the septa.

On *Psychotria pubescens* Sw., at Bayamon, February 19, 1913, no. 392 (type).

This species is separated immediately from the variety described on the same host by STEVENS as *M. glabra*. var. *psychotriae* by the presence of perithecial setae. It is also distinct from *M. psychotriae* Earle on account of its remarkably looser habit, the characteristic waviness of the mycelium, its lighter color, the shape of the capitate hyphopodia, and the strikingly short basal cell.

***Meliola marcgraviae***, sp. nov.—Colonies epiphyllous, irregular, 3-10 mm. in diameter, branching opposite, hyphae dark to opaque,  $5-6 \mu$  in diameter.

Capitate hyphopodia alternate,  $32 \mu$  distant, head-cell globose,  $11 \mu$  in diameter; basal cell short,  $5 \mu$  long. Mucronate hyphopodia mostly opposite, but frequently alternate, flask-shaped,  $12-14 \mu$  long. Mycelial and perithecial setae none.



Perithecia scattered, small, 65–75  $\mu$  in diameter. Asci soon evanescent, ascospores 4-septate, light brown, cylindrical, slightly constricted, 40  $\times$  15  $\mu$ .

On leaves of *Marcgravia rectiflora* Tr. and Planch., Porto Rico, July 16, 1915, no. 8722 (type).

The colonies formed by this *Meliola* are so inconspicuous as to pass entirely unnoticed. It is only when the leaf is placed under a lens that the colony is to be seen.

#### PHYLLACHORA NITS.

**Phyllachora quadraspora**, sp. nov.—Stroma variously shaped, mostly oval to linear, 0.5–1  $\times$  0.5 mm., with epidermal clypeus on either side of the leaf usually bilocular. Locules sub-spherical, 115–125  $\mu$  in diameter. Asci cylindrical, short-stipitate, 100–110  $\times$  10–12  $\mu$ , 4-spored; spores hyaline, granular, 1-guttulate, elliptical, 20–22  $\times$  8  $\mu$ . Paraphyses present.

On leaves of *Paspalum glabrum* Poir, Maricao, no. 8803 (type); *P. conjugatum* Bergius, Tanama River, no. 7856 (fig. 4).

In naming this species the author has endeavored to follow the monograph of the genus by THEISSEN and SYDOW.<sup>3</sup> The fact that the stroma is laid down in the mesophyll of the leaf brings the fungus into the genus *Phyllachora*; but the occurrence of only 4 spores in the ascus would seem, on the other hand, to exclude it. This, however, need not be true, since THEISSEN, in characterizing *Ph. graminis* as having spores up to 8 (“zu acht”) leaves the implication that the spore number may be fewer than 8.

#### PHYLLACHORA GRAMINIS (Pers.) Fcl. Symb. Myc. 218. 1869.

This species has previously been reported by GARMAN on an undetermined species of *Paspalum* from Sabana Grande in 1915. It is also to be noted on *Paspalum glabrum* Poir., at Rosario, no. 9495a.

**Phyllachora ischmaemi**, sp. nov.—Stromata appearing on the upper side of the leaf, circular, crowded, and often confluent, laid down in the mesophyll, 0.75–1.25 mm. in diameter. Clypeus 24–26  $\mu$  thick. Locules 2-several in a stroma, spherical to flask-shaped, 125–145  $\mu$  in diameter. Asci cylindric to clavate, 105–150  $\times$  10–12  $\mu$ , 8-spored. Spores hyaline, spherical, uniseriate, 8  $\mu$  in diameter, with a single guttula. Paraphyses present, filiform.

On leaves of *Ischmaemum latifolium*, St. Pierre, Martinique Island, no. 2972 (type) (figs. 2, 3).

<sup>3</sup> THEISSEN, F., and SYDOW, H., Die Dothidiales. Ann. Mycologici 13:437. 1915.

## STIGMATEA Fries

*Stigmatea guettardae*, sp. nov.—Spots large, 0.5–3 cm. in diameter, irregular, light brown or red in young stages and ashy or white in old stages, always sharply defined by a dark brown border.

Perithecia epiphyllous, gregarious, grouped in the center of the spot, small, black, 60–80  $\mu$  in diameter. Ostiole erumpent, small, 6–10  $\mu$  in diameter. Asci obliquely oblong, short and abruptly stipitate, obtuse above, 25–40  $\times$  8–11  $\mu$ , 8-spored. Spores long-elliptic, 2-celled, the septum at or nearly at the center, slightly constricted, hyaline, 11–13  $\times$  2–3  $\mu$ . Paraphyses present, long, filiform, septate, hyaline to yellowish.

On *Guettarda ovalifolia* Urb., Maricao, January 10, 1913, no. 191 (type); Barros, January 2, 1913, no. 164; Maricao, April 5, 1913, no. 771; July 19, 1915, no. 8804; Monte Alegrillo, no. 4741; Indiera Fria, Maricao, October 8, 1913, no. 3338.

On *Guettarda scabra* (L.) Lam., Tanama River, July 6, 1915, no. 7851.

## PHAEOSPHAERELLA Karst.

*Phaeosphaerella paspali*, sp. nov.—Perithecia amphigenous, sunken, sub-spherical, 125–137  $\mu$  in diameter; ostiole minute, 10–15  $\mu$  in diameter. Asci crowded, sub-cylindric, 55–60  $\times$  8  $\mu$ , 8-spored; spores brown, oblong to fusoid, unequally 1-septate, slightly constricted at the septum, 12–15  $\times$  3–5  $\mu$ . Paraphyses none.

On leaves of *Paspalum glabrum* Poir., Maricao, no. 8803a (type) (fig. 5).

## CONIOTHYRIUM Corda

*Coniothyrium marisci*, sp. nov.—Spots oval to linear, yellowish, with a dark brown margin. Pycnidia gregarious, amphigenous, sub-spherical, 120–130  $\mu$  in diameter, subepidermal, only the ostiole erumpent. Perithecial wall thick (35  $\mu$ ); ostiole 16–20  $\mu$  in diameter. Spores dark brown, ellipsoid or globose, 5–7  $\times$  2.5  $\mu$ . Conidiophores not apparent.

On *Mariscus jamaicensis* (Crantz) But., no. 124 (type) (fig. 6).

## PESTALOZZIA De Notaris

*Pestalozzia lucumae*, sp. nov.—Spots epiphyllous, black, irregular, 2–5 mm. in diameter. Acervuli subepidermal, erumpent,



white or ashy at maturity, 0.5–2 mm. in diameter, crowded on the stroma, circular or elongate, and rupturing irregularly. Conidia elliptic or slightly falcate,  $14-18 \times 4-5 \mu$ , 4-septate, slightly constricted; central cells fuscous, end cells hyaline, the apical cell conic, ornamented by 2 widely divergent, hyaline, filiform setae 7–10  $\mu$  long, basal cell prolonged into a single hyaline seta 3–5  $\mu$  in length.

On leaves of *Lucuma multiflora* A. DC., Monte Alegre, July 20, 1913, no. 2301 (type).

It was a surprise to find this specimen a *Pestalozzia*. Its superficial characters suggest strongly a Phacidiaceous form, but a close examination reveals the fact that instead of an ascoma, the fruiting body is an acervulus. The acervuli are grouped closely on a large stroma which causes a characteristic black spot on the leaf.

### HELMINTHOSPORIUM Link

HELMINTHOSPORIUM FOLLICULATUM Corda var. BREVIPILOM Corda, Icon. 2:13, 1838.

On *Paspalum conjugatum* Bergius, Tanama River, July 6, 1915.

### ACROTHECIUM Preuss.

**Acrothecium flacatum**, sp. nov.—Mycelium light olivaceous, septate, 2.5  $\mu$  in diameter, attacking the spikelets and thickly covering the glumes and awns of the flowering heads. Conidiophores dark olivaceous in color, straight, somewhat bulbous at the base,  $96-125 \times 5 \mu$ . Spores olivaceous, luniform, 3 or 4-septate, borne apically on the conidiophores in fascicles of 3–5,  $35 \times 10 \mu$ ; central cell very much enlarged, dark, and not equilateral; the terminal cells small and nearly hyaline.

On *Setaria* species, Porto Rico, 1915, no. 9181 (type) (fig. 1a, b, c).

Another fungus belonging to this genus and possessing the same strikingly characteristic spore is generally reported as the cause of the "ringspot" of sugar cane. It was first mentioned by BREDA DE HAAN in 1892, and was thought by him to be the conidial stage of *Leptosphaeria sacchari*. In 1898 a fungus identical with that of BREDA DE HAAN'S was described by WAKKER<sup>4</sup> on dead leaves of sugar cane under the name of *Acrothecium lunatum*.

The present species, however, is clearly distinct from that described by WAKKER, in that the conidia are more frequently 4-septate than 3-septate, distinctly larger, and regularly borne in fascicles of 3–5 on the tips of the

<sup>4</sup> WAKKER, J. H., and WENT, F. A. F. C., De Ziekten van het Suikerriet op Java. pp. 149, 196. Leiden, 1898.

conidiophores. Cultures of *Acrothecium lunatum* frequently show a secondary group of spores borne below the apical group. Furthermore, the 2 hosts being so widely separated phylogenetically, it is probable that they would not be attacked by the same parasite.

### CERCOSPORA Fries

CERCOSPORA PERSONATA (B. and C.) Ellis, Jour. Mycol. 1885.

On the leaves of *Arachis hypogaea* L., Trujillo Alto, August 17, 1915, nos. 2506, 2447.

These specimens agree in general with the species, comparison having been made with reliable exsiccati. They do present a peculiarity, however, in that the spots are consistently smaller, and much more regularly circular in outline.

### TRICHOSTROMA Corda

**Trichostroma axonopi**, sp. nov.—Spots oval to linear, yellowish with a definite brownish or purple border. Sporodochia gregarious, black, globular to oval, verruciform, often confluent, 95–125  $\mu$  long. Setae black, straight or the tips sometimes repand, rigid, base bulbous, 65–85  $\mu$  long, few-septate. Conidia brown, globular to ovoid, 5  $\mu$  in diameter.

On leaves of *Axonopus compressus* (Sw.) Beauv., College grounds, Mayaguez, May 30, 1913, no. 924 (type).

### EXPLANATION OF PLATE XVIII

FIG. 1.—*Acrothecium falcatum*: conidiophore and conidia (*a*, *b*, *c*).

FIG. 2.—*Phyllachora ischmaemi*: section of stroma.

FIG. 3.—*Phyllachora ischmaemi*: ascus.

FIG. 4.—*Phyllachora quadraspora*: ascus.

FIG. 5.—*Phaeosphaerella paspali*: ascus.

FIG. 6.—*Coniothyrium marisci*: section of pycnidium.

FIG. 7.—*Coccomyces musae*: ascus and ascospores.

FIG. 8.—*Coccomyces clusiae*: habit sketch of single ascoma.

FIG. 9.—*Coccomyces clusiae*: old and empty ascoma showing honeycombed appearance of floor.

FIG. 10.—*Coccomyces clusiae*: cross-section of ascoma showing localization of ascus producing hymenium which results in honeycombed appearance seen in fig. 9.

FIGS. 11–16.—*Meliola asterinoides*.

FIG. 11.—Beginning of perithecium: *a*, large swollen tip; *b*, smaller thumblike projection.

